Sediments and Dredging

Background, Permitting, Management

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Outline

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Background

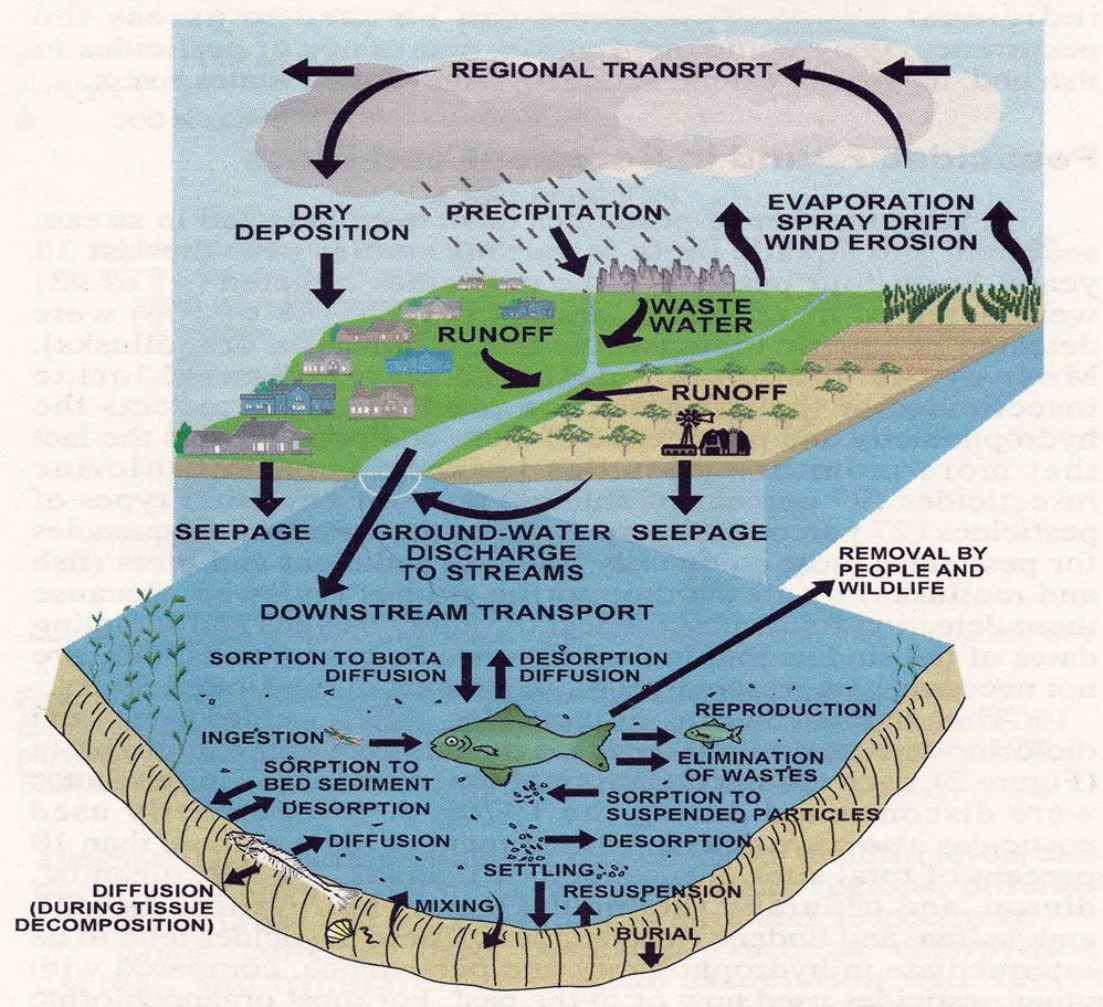
Sediment

Sediment

"Sediment" means particles in the bed of a navigable water up to the ordinary high-water mark that are derived from the erosion of rock, minerals, soil, and biological materials and from chemical precipitation from the water column and that are transported or deposited by the water. - 292.02(17g) Stats

Contaminated Sediment


Contaminated!
Toxic!


REGIONAL TRANSPORT
DRY DEPOSITION
PRECIPITATION
EVAPORATION
SPRAY DRIFT
WIND EROSION
WASTE WATER
RUNOFF
RUNOFF
SEEPAGE
GROUND-WATER DISCHARGE TO STREAMS
SEEPAGE
REMOVAL BY PEOPLE AND WILDLIFE
DOWNSTREAM TRANSPORT
SORPTION TO BIOTA DIFFUSION
DESORPTION DIFFUSION
REPRODUCTION
INGESTION
ELIMINATION OF WASTES
SORPTION TO BED SEDIMENT
DESORPTION
SORPTION TO SUSPENDED PARTICLES
DIFFUSION
DESORPTION
SETTLING
DIFFUSION (DURING TISSUE DECOMPOSITION)
MIXING
RESUSPENSION
BURIAL

Risk

- Toxicity = Degree to what a substance can cause harm to an organism.
- Acute vs. Chronic Toxicity
- Risk = Toxicity x Exposure

There are known knowns... We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns – the ones we don't know we don't know.

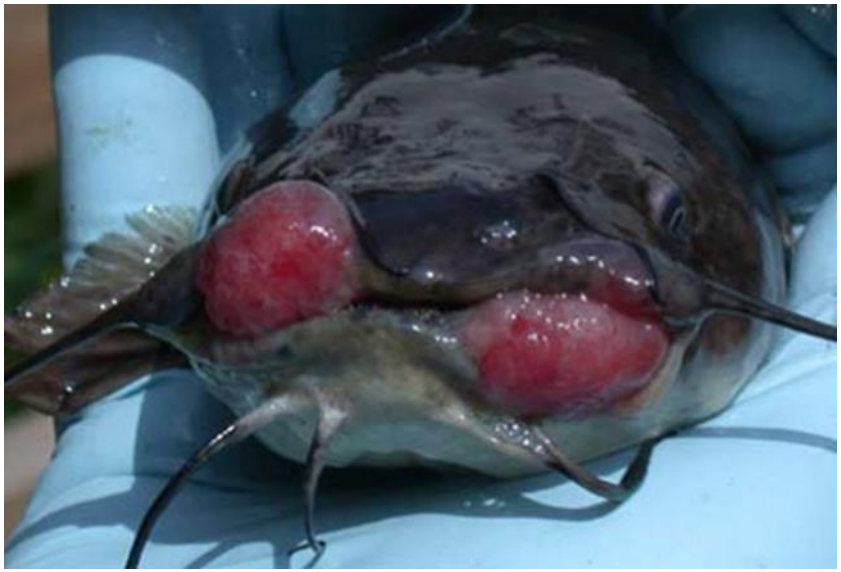
Donald Rumsfeld

Preliminary application and analytical requirements.

- Provide the department with preliminary information including:
- Name of waterbody and location of project;
- Volume of material to be dredged;
- Dredging method and equipment;
- Proposed disposal method and location and, if a disposal facility is to be used, size of the disposal facility;
- Any previous sediment sampling (including field observations) and analysis data from the area to be dredged
- Map showing the area to be dredged, the depth of cut, the specific location of the proposed sediment sampling sites and the bathymetry of the area to be dredged;
- Starting and completion dates of the proposed project.

PAHs

- Polycyclic aromatic hydrocarbons
  - Cause internal/external lesions and tumors in fish
  - Affect benthic macroinvertebrates (acute and chronic toxicity)
  - Human exposures through air, eating/drinking and direct contact



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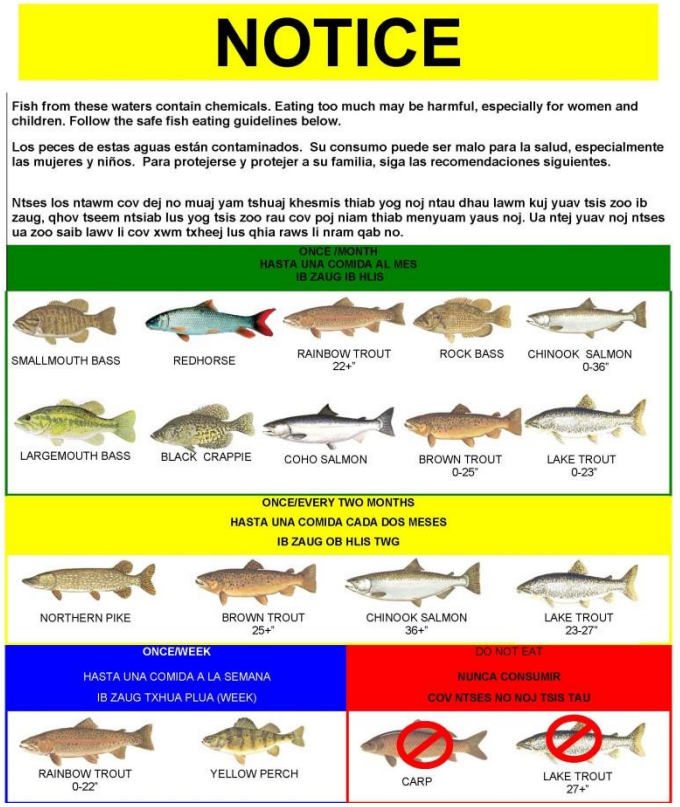
PCBs

- Polychlorinated Biphenyls
  - Legacy pollutant
  - 209 different chemical compounds
  - Degrade very slowly
  - Collect in fatty tissues
  - Magnifies through food chain
  - Fish consumption advisories



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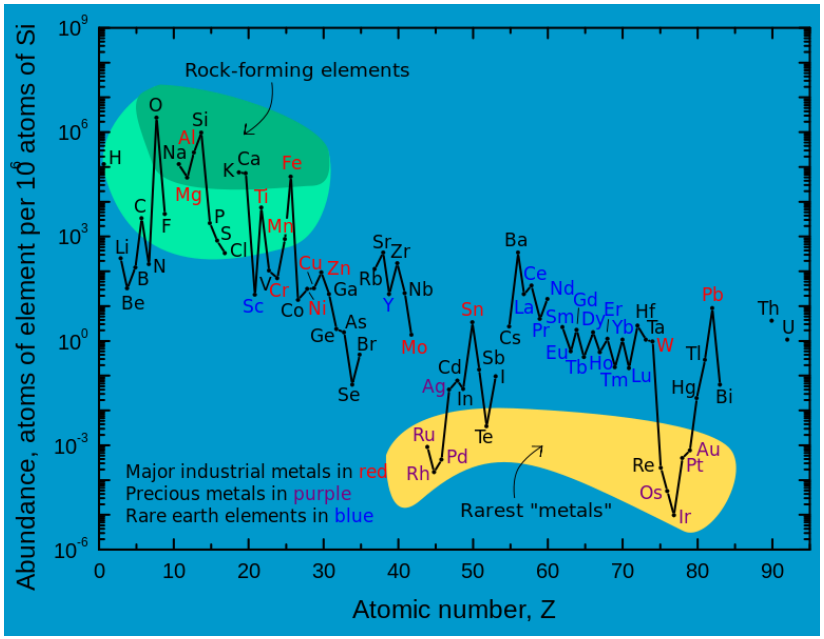
Metals

- Present in crust
- Availability varies
- Arsenic, Cadmium, Copper, Chromium, Mercury, etc.



Pesticides

- Organic Pesticides:
  DDT, DDE, Chlordane
- Historical use
- Inorganic Pesticides:
  Copper and Arsenic

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Other

- Nutrients
- Ammonia
- Sediment size
- Total Organic Carbon
- Elutriate

TEC MEC PEC

WTHeck?

CBSQGs

Table 1. Recommended Sediment Quality Guideline Values For Metals and Associated Levels of Concern To Be Used In Doing Assessments of Sediment Quality.

Metal	mg/kg dry wt.**							
	Level 1 Concern ≤ TEC	TEC	Level 2 Concern > TEC ≤ MEC	MEC	Level 3 Concern > MEC ≤ PEC	PEC	Level 4 Concern > PEC	Source of SQG Effect-Based Concentrations
Antimony	←	2	↔	13.5	↔	25	→	NOAA (1991) [1]
Arsenic	←	9.8	↔	21.4	↔	33	→	CBSQG (2000a)[2]
Cadmium	←	0.99	↔	3.0	↔	5.0	→	CBSQG (2000a)
Chromium	←	43	↔	76.5	↔	110	→	CBSQG (2000a)
Copper	←	32	↔	91	↔	150	→	CBSQG (2000a)
Iron	←	20,000	↔	30,000	↔	40,000	→	Ontario (1993) [3]
Lead	←	36	↔	83	↔	130	→	CBSQG (2000a)
Manganese	←	460	↔	780	↔	1,100	→	Ontario (1993)
Mercury	←	0.18	↔	0.64	↔	1.1	→	CBSQG (2000a)
Nickel	←	23	↔	36	↔	49	→	CBSQG (2000a)
Silver	←	1.6	↔	1.9	↔	2.2	→	BC (1999) [4]
Zinc	←	120	↔	290	↔	460	→	CBSQG (2000a)

** The CBSQGs for organic compounds are expressed on a dry weight concentration at 1% TOC in sediments. However, unlike the organic compounds, the CBSQG and study site metals concentrations can be compared on a bulk chemistry basis and do not need to be adjusted to a 1% TOC basis to do the comparison. TOC does not play the same role in determining metals availability as it does in determining organic compound availability.

1. NOAA (1991) = Long, E.R. and L.G. Morgan. 1991. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52. National Oceanic and Atmospheric Administration. Seattle, Washington.

2. CBSQG (2000a) = MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000a. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.

3. Ontario (1993) = Persaud, D.R., R. Jaagumagi, and A. Hayton. 1993. Guidelines for the protection and management of aquatic sediments in Ontario. Standards Development Branch. Ontario Ministry of Environment and Energy. Toronto, Canada.

4. MacDonald, D.D. and M. MacFarlane. 1999. (Draft). Criteria for managing contaminated sediment in British Columbia. British Columbia Ministry of Environment, Lands, and Parks. Victoria, British Columbia.

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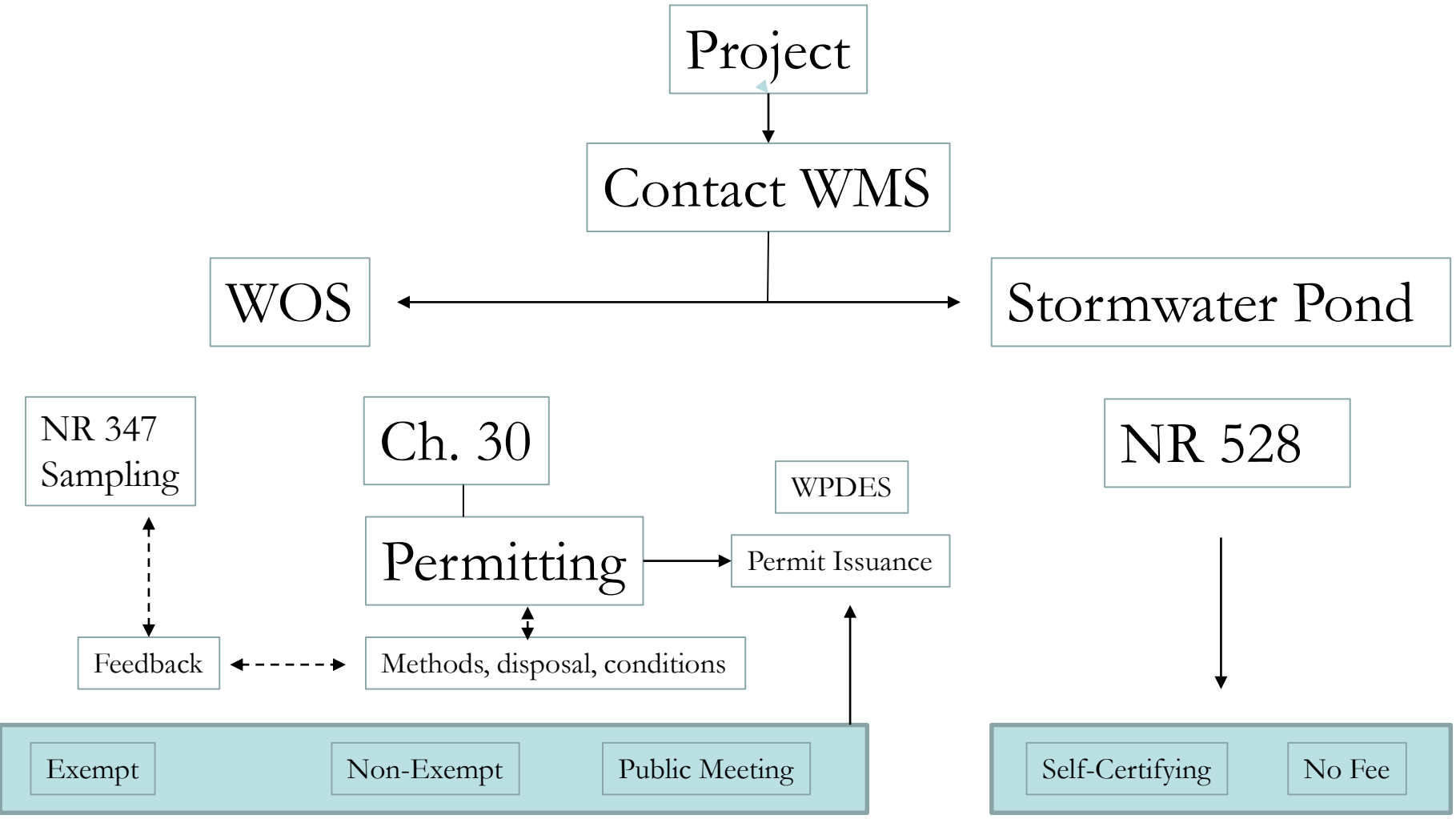
Permitting and Management



https://dnr.wi.gov/files/PDF/pubs/WT/WT0778.pdf

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Questions?